Center for Risk Excellence

Risk Excellence Notes

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THE MEANING OF RISK

By Arthur C. Upton, UMDNJ-Robert Wood Johnson Medical School

The importance attached to a given risk depends heavily on the probability of its occurrence and the severity of its impact on those who may be affected. Yet, other factors will influence how the risk may be perceived by a particular individual. These include the extent to which acceptance of the risk is seen to be offset by a commensurate benefit, and the degree to which the risk is involuntary, unfamiliar, potentially catastrophic, inequitable, or poorly understood. In this respect, "risk," like "beauty," is in the eye of the beholder.

While all of these factors need to be considered appropriately in arriving at sound regulatory decisions on environmental risks, the process is complicated in practice by many problems. Gaps in existing knowledge severely limit the quality of hazard identification, exposure assessment, dose-response analysis, and risk characterization that is feasible for many of the potentially toxic chemical and physical agents in the environment. Efforts to assess the risks attributable to low-level exposure to such agents either encountered alone or in various combinations, are especially apt to be fraught with uncertainty. Furthermore, the uncertainties inherent in such assessments often give rise to heated controversies in the scientific community, which lead to confusion, cynicism, and distrust in the public at large. The problems in risk assessment and risk management are thus compounded by problems in risk communication.

The technical problems in risk assessment cannot be solved without research to fill the relevant knowledge gaps. In the meantime, the problems in risk communication must be addressed by adequately involving the concerned stakeholders in the risk assessment process. Effective risk communication requires a two-way exchange of information. Hence the failure to adequately involve stakeholders in a risk assessment may result in their failure to understand the assessment, trust it, and accept it.

It can be concluded that in a democratic society such as ours, apart from those risks which are universally considered to be negligibly small, decisions on the acceptability of a given risk for the public at large need to be reached consensually, with the active input of all who may be concerned.

Arthur C. Upton, M.D., specializes in radiobiology, pathology, carcinogenesis, and environmental health. He is the peer review chairperson for the Consortium for Risk Evaluation with Stakeholder Participation (CRESP), a member of numerous committees, and a former Director of the National Cancer Institute. For a recent CRESP review of the U.S. Department of Energy's use of risk in environmental decisions see http://www.cresp.org/emsp/upton.pdf. Dr. Upton can be reached at 732/235-9606; email acupton@eohsi.rutgers.edu.

LETTER FROM THE EDITORS

Risk. We face it everyday and either accept it, and take our chances, or choose a less harmful way. It is a very familiar aspect of each of our lives. Our societies too are faced with many decisions for which they must either accept the risk or choose another way.

In this issue, we have gathered some philosophies that different cultures use in approaching risk. We offer you thoughts on what risk means, how it is used in reaching consensus and radiation protection, and a glimpse at the Precautionary Principle. Two countries from the International Risk Network provide a peek at their struggle to use risk in a meaningful way. In "Speak Your Mind" concerns and suggestions are given for evaluating risk.

The authors in this issue have done an exceptional job in a small amount of space and we thank them immensely.

Nancy Lane
Lane Environmental, Inc.

Mary Jo Acke Ramicone
U.S. Department of Energy
Center for Risk Excellence

WHAT'S HAPPENING AT THE Center for Risk Excellence

An Editorial from the Director of the U.S. Department of Energy's Center for Risk Excellence —

A NEW ADMINISTRATION, AN OPPORTUNITY TO STRENGTHEN RADIATION POLICY

Radiation and radioactive materials are ubiquitous in our natural environment and in virtually every aspect of human endeavor: health, space exploration, communications, energy production, defense, and foreign affairs.

Life on earth has evolved in a sea of radiation from space and from the elements that constitute our planet. Whether they are electromagnetic waves ("ionizing" and "nonionizing") that emit radiant energy, or radionuclides that emit ionizing particles, radiation sources have beneficial and/or detrimental attributes (health and environmental risks). Total avoidance of exposure to radiation is neither feasible nor possible.

What is essential is that federal policy and programs involving exposure to or use of sources of radiation are well coordinated and integrated within the administration. In the United States, at least 18 federal agencies have responsibility to propose and implement policies related to radiation regulation or research. Creation and maintenance of a multi-disciplinary policy group to evaluate and coordinate radiation issues across agencies is critical to achieving consistent policies and programs.

Beginning with the Eisenhower administration, the federal government recognized in establishing the Federal Radiation Council the need for an executive organization to ensure that matters of federal policy involving radiation and radioactive materials would receive interagency review, based on sound science. Subsequently, President Carter established the Radiation Policy Council to provide coordination, and President Reagan established the Committee on Interagency Radiation Research and Policy Coordination (CIRRPC), which continued to provide coordination of radiation policy under President George Bush. For 11 years

(Continued on Page 3)

INTERAGENCY STEERING COMMITTEE ON RADIATION STANDARDS (ISCORS)

This free-standing committee, formed in 1994, builds consensus on acceptable levels of radiation risk to the public and workers. Represented on the committee are six U.S. agencies (the U.S. Environmental Protection Agency [EPA], U.S. Nuclear Regulatory Commission [NRC], U.S. Department of Energy, U.S. Department of Defense, U.S. Department of Transportation, the Occupational Safety and Health Administration of the U.S. Department of Labor, and the U.S. Department of Health and Human Services).

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For more information see the ISCORS web site http://www.iscors.org.

WHAT'S HAPPENING AT THE Center for Risk Excellence

A New Administration, An Opportunity to Strengthen Radiation Policy
(Continued from Page 2)

CIRRPC provided coordination of radiation policy for its 18 member agencies and was recognized, nationally and internationally, as the focal point for U.S. federal interagency radiation activities.

In 1992, President Clinton established the National Science and Technology Council, of which all federal agencies that fund science are a member. Administration and support for a separate committee to deal with radiation issues dwindled and in 1995 the administration abolished CIRRPC. Subsequently, responsibility for radiation matters was left with the U.S. Environmental Protection Agency (EPA). The federal government has since failed to provide a mechanism for interagency resolution of common issues related to radiation policy whether for cleanup standards, compensation, measurements, public education or guidance for risk assessments. As noted in the September 1994 report of the General Accounting Office (GAO/RCED-94-190), EPA deals directly with other agencies on radiation policy, rather than through an interagency forum. EPA is chiefly influenced by its regulatory responsibilities and its views on radiation policy matters are shaped accordingly. For example, EPA is influenced by its very restrictive approach in regulating by individual pathways, e.g., 4 mrem standard for water, 4 mrem standard for air, etc., as opposed to the total pathway standard used by the U.S. Nuclear Regulatory Commission. This has led to independent action without consensus, rather than to cooperation in addressing radiation issues.

This new administration has the opportunity to transfer the radiation guidance authority back to the Executive Office of the President, and to re-establish interagency coordination to achieve government-wide consensus and to use interagency mechanisms to resolve common issues. The federal government needs the benefits that can be derived from interagency consensus and the nation needs the advantages that can be derived from the use of nuclear energy to continue the country's economic expansion in the 21st century.

Alvin L.Young, Director
U.S. Department of Energy's Center for Risk Excellence

Dr. Young was chairman of CIRRPC 1984-1995. For more thoughts on this topic see the section entitled Harmony and Conflict in Radiation Protection in this newsletter.

DIALOGUE ON FEDERAL-INDIAN TRUST RESPONSIBILITY

By Celeste Durant, International Institute for Indigenous Resource Management

A two-day workshop was held in Denver, Colorado on "Implications of the Federal Indian Trust Obligation, Treaties, Agency Policy and Indian Law on Federal Facilities Cleanup in Indian Country."

The workshop, organized by the International Institute for Indigenous Resource Management (IIIRM, or the "Institute"), featured presentations on the role of the Federal-Indian Trust relationship in waste cleanup in Indian country, tribal rights and authorities, and cultural resource preservation.

Al Young, Director of the U.S. Department of Energy's Center for Risk Excellence, said that for years federal agencies have ignored cultural risk and how to assess it. However, the Center has joined with the U.S. Environmental Protection Agency (EPA), the American Society of Testing and Materials (ASTM) and the Institute in a cutting-edge multiyear project to develop objective quality of life standards to assess cultural, health, social and economic risk.

Workshop participants said they were surprised by the free exchange of ideas achieved in the sessions. "When I arrived I expected a one-way transfer of information to assist tribal members to better participate in the process," James Van Ness said, "but it turned out to be a productive and effective dialogue."

The session was co-sponsored by the Institute, the U.S. Department of Defense, the EPA, and the Center for Risk Excellence.

For more information, contact Mervyn L. Tano, President IIIRM (303/733-0481; email mervtano @iiirm.org; web site http:// www.iiirm.org).

WHAT IS THE CENTER FOR RISK EXCELLENCE?

The Center for Risk Excellence was established in 1997 to help the U.S. Department of Energy (DOE) address risk issues associated with its environmental management activities. The Center's mission is to provide leadership, expertise, and integration of risk activities through strategic partnerships, to manage risk using science and technology, and to enhance the understanding of environmental risks. Located at the Chicago Operations Office, the Center provides field-based risk expertise and resource coordination to those in Headquarters, the Field/Operations Offices, and outside the agency. With a federal staff of seven, the Center has created an extended organization combining DOE staff from each of its field offices (i.e., Board of Advisors), DOE laboratories (i.e., Support Team), Cooperative Agreement Institutions, contractors, and other organizations. For more information, call 888-DOE-RISK or visit the web site http://riskcenter.doe.gov.

PHILOSOPHIES OF RISK

REACHING CONSENSUS

WHAT IS PHILOSOPHY OF RISK?

By Sven Ove Hansson, Royal Institute of Technology - Sweden

Philosophy of risk is one of the smaller risk disciplines, but nevertheless a highly useful one. We can define it as the philosophical study of decision-making under risk and uncertainty. It is based on insights and results from epistemology, decision theory, and moral philosophy.

This is a new branch of philosophy. It is small, but growing. A bibliographical search of the Philosopher's Index resulted in references to about 650 philosophical works dealing with issues of risk. The rate of new philosophical publications about risk was about 1 per year in the 1950s and 1960s, 10 per year in the 1970s (with a marked increase during that decade), and 30 per year in the 1980s and 1990s.

Some major issues in the philosophy of risk are:

- **The clarification of basic concepts such as risk, uncertainty, and safety;**
- **The relation between science and values in risk assessment;**
- **The burden of proof in risk assessment;**
- **The role of decision criteria such as expected utility maximization and the precautionary principle; and,**
- **Moral issues in relation to risk, such as: rights and risk, risk-taking and risk imposition, paternalism and voluntariness, equity, applications to business ethics etc.**

We have recently formed a research group at the Royal Institute of Technology in Stockholm that specializes in the philosophy of risk. In order to facilitate communication between researchers and others interested in the philosophy of risk we have started a newsletter, the *Philosophy of Risk Newsletter,* that will appear with intervals of 1-3 months. New literature in the field is reported in the newsletter.

For information on subscription, see the web site (http://www.infra.kth.se/phil/) or contact Sven Ove Hansson (email soh@infra.kth.se).

RISK AND TRUST

By Paul Slovic, Decision Research and University of Oregon

One reason why the public often rejects scientists' risk assessments is lack of trust. This lack of trust greatly reduces the effectiveness of risk communication efforts. If you trust the risk manager, communication is relatively easy. If trust is lacking, no form or process of communication will be satisfactory.

One of the most fundamental qualities of trust has been known for ages. Trust is fragile. It is typically created rather slowly, but it can be destroyed in an instant by a single mishap or mistake. Thus, once trust is lost, it may take a long time to rebuild it to its former state. The fact that trust is easier to destroy than to create reflects certain fundamental mechanisms of human psychology called the "asymmetry principle." When it comes to winning trust, the playing field is not level. It is tilted toward distrust for the following reasons:

Negative (trust-destroying) events are more visible or noticeable than positive (trust-building) events. Negative events often take the form of specific, well-defined incidents such as accidents, lies, discoveries or errors, or other mismanagement. Positive events, although sometimes visible, more often are fuzzy or indistinct. Adding fuel to the fire of asymmetry is yet another idiosyncrasy of human psychology sources of bad (trust-destroying) news tend to be seen as more credible than sources of good news.

Another important psychological tendency is that distrust, once initiated, tends to reinforce and perpetuate itself. This occurs in two ways. First, mistrust tends to inhibit the kinds of personal contacts and experiences that are necessary to overcome distrust. Second, initial trust or distrust colors our interpretation of events, thus reinforcing our prior beliefs.

Appreciation of those psychological principles leads us toward a new perspective on risk assessment, trust, and conflict. Scientific analysis of risk cannot allay our fears of low-probability catastrophes or delayed cancers unless we trust the system. The limitations of risk science and the importance and difficulty of maintaining trust, point to the need for a new approach to risk management, one that focuses on introducing more public participation into both risk assessment and risk decision-making. This will make the decision process more democratic, improve the relevance and quality of technical analysis, and increase the legitimacy and public acceptance of the resulting decisions.

Paul Slovic is President of Decision Research and Professor of Psychology at the University of Oregon. For more information see his recent publications The Perception of Risk *or* Risk, Media and Stigma *available in the U.S. from*

Stylus Publishing (703/661-1581) and overseas from EARTHSCAN +44 (0) 20 7278 0433. He can be contacted at 541/485-2400; email pslovic@oregon.uoregon.edu, web site www.decisionresearch.org.

SO, WHAT DO YOU THINK?

Please visit the Center's web site at

http://riskcenter.doe.gov

and share your thoughts about the newsletter and our web site.

PHILOSOPHIES OF RISK

REACHING CONSENSUS

THE CHALLENGE OF FUTURE ENVIRONMENTAL DECISIONS AND THE USE OF RISK ASSESSMENT

By Loren Habegger and Margaret MacDonell, Argonne National Laboratory

Regulatory agencies, the scientific community, and other interested and affected groups often have difficulty reaching consensus on appropriate strategies for a range of environmental issues (Table 1). There are common features to these issues. For example:

- Limited resources often force tradeoffs;
- Objectives sometimes conflict;
- Public values and interests cover a wide range; and,
- Risks that are agreed upon contain uncertainty.

These common features offer impetus to devise new or revise current environmental management approaches. In addition, scientific discovery will likely continue to introduce new environmental issues that will challenge current decision and management approaches. Moreover, today risks must be considered in the broader context of the world.

Further research and development in several areas are required to achieve more effective and more integrated environmental decision-making. Tools are needed for:

- Performing aggregate, cumulative risk assessment, including for mixtures;
- Conducting valuations of ecosystems and evaluations of sustainability;
- Balancing short-term economic impacts with long-term health and ecosystem risks;
- Eliciting and clarifying public values and interests and constructing environmental objectives consistent with a diversity of values and interests;
- Structuring innovative management approaches within current regulatory, economic, and socio-cultural constraints; and,
- Monitoring performance (short and long term) and updating management approaches based on results.

Table 1. DECISION MAKING CHALLENGES FOR CURRENT ENVIRONMENTAL ISSUES

ENVIRONMENTAL ISSUE	FEATURES THAT CHALLENGE DECISION-MAKING
Global climate change	Uncertain impacts; need for international coordination; economic tradeoffs
Genetically modified organisms	Uncertain impacts; risk perceptions; impact on international trade
Nuclear materials and wastes	Risk of low-level exposures; risk perceptions; long-lived hazards
Numerous sites with low-level contamination; closure on the cleanup	Future land use; worker and ecological risk vs. public risk; high cost of further cleanup
Urban environments; making our cities livable	Diverse values and interests; environmental justice
Trans-boundary air pollutants, especially persistent organic pollutants and fossil energy emissions	Uncertain impacts; need for international coordination; risk perceptions
"Safe" contaminant levels, e.g., for endocrine disrupters, synergistic effects (mixtures, other environmental factors)	Uncertain low-level dose-response; risk perceptions
Natural ecosystems, biodiversity	Diverse values and interests; economic tradeoffs
Watersheds to provide adequate quality and quantity of water	Future demographics, economic development, land use; inter-regional competition
Alternative energy sources	Resource availability; economic tradeoffs; nuclear risk perceptions

For more information contact Loren Habegger (630/252-3761; email lhabegger@anl.gov) or Margaret MacDonell (630/252-3243; email macdonell@anl.gov).

RISK MANAGEMENT TECHNIQUES FOR HUMANITARIAN DE-MINING

By Julian Williams, AEA Technology

Land mines present a dangerous and serious obstacle to communities trying to rebuild themselves post-war. Mine clearance could make the land available again. Unfortunately, the areas affected are vast, and the funds and time for mine clearance are limited. The challenge is to develop a strategy to maximize the overall benefit to the communities within the limited resources available. This can be achieved by adopting the principle of "fit for purpose" using a risk-based approach.

An important consideration for society in deciding upon acceptable risks is how important the land-use is in the context of society's objectives, such as economic growth, population density or sustainability. What is unacceptable in western industrialized countries may be more acceptable in less developed countries, where the people are exposed to more hazardous situations, and the benefits of mine clearance can be marked in enabling a community to survive where otherwise it might not. Setting an "acceptable risk" for a community can be difficult and needs to take account of the perception of different types of risks.

The clearance of mines will always be a balance between clearance to the highest standard and clearance of the maximum area. Visible success stories in mine clearance may themselves encourage donors and the affected communities to continue their support for the humanitarian de-mining, reducing the misery caused to many communities from land mines.

For more information, contact Julian Williams (email julian.williams@ aeat.co.uk; phone +44 1925 254794.)

PHILOSOPHIES OF RISK

THE PRECAUTIONARY PRINCIPLE

EDITORS' NOTE: *Throughout the 1990s we heard much about "the precautionary principle," yet its definition is still under debate today. In general, this principle suggests that there be action to prevent harm to the environment and human health; in light of scientific unknowns. It promotes the notion that when solving environmental problems one can assume 1) science will not always provide information needed in a timely manner, 2) the cost of preferred actions may be prohibitive, and 3) biological resources will be lost as one waits for more knowledge to make the decision. In the broadest sense this approach recognizes that there is uncertainty, there is ignorance, and there is that which cannot be known — and still we must choose a path. Sometimes the path chosen is that of no tolerance for certain chemicals (e.g., persistent toxicants). The U.S. Food and Drug Administration applied zero tolerance to food and color additives in the Delaney clause (i.e., no additive is safe if it induces cancer). Zero tolerance has also been used to preclude the development of new technology.*

THE ROLE OF RISK AND SCIENCE

By Bernard D. Goldstein, Consortium for Risk Evaluation with Stakeholder Participation

Faculty of the Consortium for Risk Evaluation with Stakeholder Participation (CRESP) have become involved in national and international deliberations concerning the Precautionary Principle, including discussion of its appropriate interpretation as a basis for environmental decision making. The Precautionary Principle has been erroneously stated by some to represent an approach distinct from science and from risk assessment. Quite the contrary, there must first be some appreciation of a potential for harm, in other words some science that suggests risk, before the Precautionary Principle can be invoked.

Risk science also plays a role in interpreting the outcome of precautionary actions. Invoking the Precautionary Principle inherently admits that we may be making a costly mistake. By definition, action founded upon less than full scientific proof has some finite risk of being unnecessary or even harmful. Further, it is axiomatic that the precautionary action imposes a significant economic or social cost on at least some segment of society – if not, the precautionary action would be taken without the need to invoke a special principle. Taking action in the circumstances of uncertain benefits and significant cost requires follow up with appropriate research to find out if the action does in fact deal effectively with the threat of serious or irreversible damage which led to its adoption.

We believe in taking precautionary actions. Clearly, however, the more precautionary we are, the more likely we will be wrong, the more likely we will have missed taking the most appropriate protective action. Accordingly, we also believe that where possible the precautionary action should be accompanied by efforts aimed at determining its effectiveness.

Dr. Goldstein's work has focused on laboratory toxicology; however, he has a long-standing interest in risk policy. He is Chair of the Committee on Naturally Occurring Radioactive Materials for the National Academy of Sciences. For more information see Environmental Health Perspectives, 1999: 107(12) or contact Bernard Goldstein (bgold@eohsi.rutgers.edu).

EUROPEAN COMMISSION'S STANCE ON THE PRECAUTIONARY PRINCIPLE

By Regina Lundgren, Independent Consultant

In February 2000, the European Commission (EC) issued a communication on the precautionary principle that could change how European Union countries assess risks. In its strictest sense, the precautionary principle holds that if an activity cannot be proven safe, it cannot be started.

The EC's communication sought to outline its approach to using the precautionary principle within a risk analysis framework. It reiterated that risk analysis should comprise risk assessment, risk management, and risk communication, and that the precautionary principle is best applied to the risk management portion of the analysis.

The communication also stresses the importance of understanding the degree of uncertainty attached to the results of a risk assessment. It advocates a transparent decision-making process with early involvement by all parties. When the decision to act is based on the precautionary principle, actions must be proportional (e.g., realizing that risk can rarely be reduced to zero) and non-discriminatory. It must also be consistent with similar measures based on an examination of potential costs and benefits of both action and inaction subject to review in light of new scientific data capable of assigning responsibility for producing the scientific evidence.

Regina Lundgren can be reached at lundgren@urx.com. The full-text of the communication is at http://europa.eu.int/comm/off/com/health_consumer/precaution.htm.

Other views on the precautionary principle:
European Chemical Industry Council *http://www.cefic.be/position/sec/pp_sec27.htm*
Food Safety & the Precautionary Principle; *http://www.info-france-usa.org/ppseminar/transcript.htm; http://www.cnie.org/nle/rsk-29.html#8a*
Risk & the Precautionary Principle *http://europa.eu.int/comm/dgs/health_consumer/library/pub/pub07_en.pdf*

PHILOSOPHIES OF RISK

HARMONY & CONFLICT IN RADIATION PROTECTION DURING CLEANUP

EDITORS' NOTE: *As evoked by Dr. Young in* An Editorial From the Director *(page 2) and mirrored by some of the articles in this section, some people feel there is a need for greater integration of radiation policies in the U.S. This section offers the perspective of some agencies involved in setting radiation policy, internationally and nationally, and a viewpoint gained from years of experience in implementing these policies. For more information see Radiation Standards: Scientific Basis Inconclusive, and EPA and NRC Disagreement Continues (GAO/RCED-00-152, June 2000).*

It is an emotional topic for many and we urge you to send in your thoughts and comments on your experiences — positive or negative — on developing policy or implementing radiation protection.

HISTORY OF ALARA

By Roger H. Clarke, International Commission on Radiological Protection (ICRP)

There has been a hundred-year history of the uses of radiation in medicine and industry. Throughout that time there has also been advice on the need to protect people from the hazards associated with exposure. For the first 60 years after the discovery of ionizing radiation (1900-1960), the ethical position was to avoid deterministic effects in occupational exposures, where the severity was directly proportional to the size of the dose. The principle of radiological exposure was to keep individuals below the relevant thresholds. Low doses of radiation were deemed beneficial, largely because the uses of radiation were for medical purposes, and radioactive consumer products abounded.

A change in philosophy was brought about by new biological information that began to emerge in the mid-1950s. There was the epidemiological evidence of excess malignancies and the first indication of leukemia cases in survivors of the atomic bombings. Previously there had been only deterministic effects, now there were stochastic effects, where the probability of the effect not severity is proportional to the size of the dose. The threshold was rejected and subsequently there has been debate over how to deal with the acceptability of the risks. From 1960 through 1990, the acceptability was determined by what was "As Low As Reasonably Achievable" (ALARA)[1] and the utilitarian ethical approach was used, whereby actions are judged for their overall consequences. The consequences were usually determined by using cost benefit analysis to compare the relevant risks and benefits in monetary terms. In principle this became — protect society and the individual will be adequately protected. The inability of utilitarian ethics to account for the inequalities of the distribution or risks and benefits across society has led, increasingly, to emphasis on individual protection.

Currently the basic principles are the same; a constraint, however, is added. The constraint is an individual-related criterion, applied to a single source in order to ensure the most exposed individuals are not subjected to undue risk (ICRP, 1991).

For the future, ICRP is considering an individual-based philosophy using a deontological or equity-based ethical approach. This starts with the premise that all individuals have unconditional rights to certain levels of protection. The principle would be the concept of controllability of sources. The system of protection would require that exposures subject to control are first justified and then restricted by individual-based Protective Action Levels. There would then be a need to further reduce exposures to as low as reasonably practicable. This system could have advantages by being similar to methods used to control other non-radioactive pollutants, thus offering potential for integrated policy.

Dr. Clarke is chairman of the ICRP. He presented this information at the 2nd Villigen Workshop sponsored by the Organization for Economic Cooperation and Development/ Nuclear Energy Agency in January 2001.

REFERENCE:

[1]Development of the ALARA phrase:
ICRP Advice, 1955 - "as low as possible"
ICRP No. 1, 1959 - "as low as practicable"
ICRP No. 9, 1966 - "as low as is readily achievable"
ICRP No. 22, 1973 - "as low as is reasonably achievable"
ICRP No. 26, 1977 - "as low as reasonably achievable"
ICRP, 1991. 1990 Recommendations of the ICRP. Publication 60. Annals of the ICRP 21(1-3).

The following is a summary of Speech S-99-30 made in October 1999 by Greta Joy Dicus of the U.S. Nuclear Regulatory Commission.

NUCLEAR LAW AND RADIATION SCIENCE

U.S. government programs for radiation protection are carried out by many federal and state agencies under various statutes. The statutes have been enacted in different times to address different issues, have been amended, and have been subjected to court decisions. The result is that U.S. radiation protection regulations are often redundant, are sometimes in conflict with each other, and are not in harmony with radiation protection.

The U.S. Nuclear Regulatory Commission (NRC) approach to radiation protection standards is to establish radiological protection based on an *all-pathway*s and to incorporate the application of "*as low as reasonably achievable*" (ALARA). It is consistent with recommendations from the National Council on Radiation Protection and Measurements (NCRP) and the International Commission on Radiological Protection (ICRP) who have offered recommendations since the 1950s and 1920s, respectively. ICRP recommendations are largely adopted worldwide.

Recognizing the differences in approaches between agencies, the U.S. Environmental Protection Agency (EPA) and NRC have taken steps to coordinate radiation protection activities, most notably in an umbrella Memorandum of

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PHILOSOPHIES OF RISK

HARMONY & CONFLICT IN RADIATION PROTECTION DURING CLEANUP

EPA'S GUIDANCE

RADIATION RISK ASSESSMENT

***Soil Screening Guidance for Radionuclides (SSGR): User's Guide* (OSWER 9355.4-16A)**
***SSGR: Technical Background Document* (OSWER 9355.4-16) can be found at http://www.epa.gov/superfund/resources/radiation/radrisk.htm. These guidance documents are intended to provide information on soil screening for radionuclides when setting remediation goals at CERCLA sites with radioactive contamination. An electronic version of the risk assessment and groundwater leaching equations in the *SSGR: User's Guide* is also available. These equations update those in *Risk Assessment Guidance for Superfund Part B for setting Preliminary Remediation Goals*. A model that goes with the documents may be found at http://risk.lsd.ornl.gov/rad_start.shtml**

GROUNDWATER

***Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Groundwater at CERCLA Sites* (OSWER 9283.1-12) http://www.epa.gov/superfund/resources/gwguide/gwfinal.pdf and http://www.epa.gov/superfund/resources/gwguide/gwapps.pdf**

***The Role of CSGWPPs in EPA Remediation Programs* (OSWER 9283.1-09): http://www.epa.gov/superfund/resources/csgwpp/role.pdf**
UMTRCA as an ARAR (OSWER 9200.4-25): http://www.epa.gov/superfund/resources/radiation/pdf/umtrcagu.pdf

LAND USE/INSTITUTIONAL CONTROLS

***Land Use in the CERCLA Remedy Selection Process* (OSWER 9355.7-04) http://www.epa.gov/superfund/resources/landuse.pdf**
***Institutional Controls: A Site Manager's Guide to Identifying, Evaluation and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups* (OSWER 9355.0-74FS-P): http://www.epa.gov/superfund/resources/institut/guide.pdf**

(Continued from Page 7)

Understanding (MOU) signed in 1992 that establishes principles and procedures for avoiding unnecessary duplication and focuses priority on the most significant safety and environmental problems. While some activities have met the objective of the MOU, other attempts have not been successful. In 1997, NRC approved a rule that establishes an individual, all-pathways release criterion of 25 millirem per year plus ALARA for unrestricted release of contaminated facilities and termination of licenses. It is consistent with recommendations of the ICRP and NCRP. The EPA's guidance for remediation of contaminated sites covered under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) is more restrictive. In the context of CERCLA, EPA has determined that the NRC dose limit of 25 mrem per year results in a cancer incidence (not fatality) risk of 5×10^{-4} and states in its guidance that it is unacceptable. Recognizing the lack of finality this disagreement results in for licensees seeking to decommission sites, the NRC is working with EPA to eliminate any potential dual regulation and recognizes that a more permanent solution may require legislation. This would also improve the efficiency in decommissioning of sites by reducing the confusion, site cleanup delays, and increased costs that result from the lack of finality.

The full text is available on the web at http://www.nrc.gov/OPA/gmo/nrarcv/s99-30.html.

RISK-BASED CLEANUP LEVELS UNDER SUPERFUND

By Stuart Walker, U.S. Environmental Protection Agency

Cleanup levels under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, e.g. Superfund) are often determined by compliance with the requirements of other laws, (e.g., Applicable or Relevant and Appropriate Requirements [ARARs]). Where ARARs are not available or are not sufficiently protective, the U.S. Environmental Protection Agency (EPA) generally sets site-specific remediation levels. Carcinogens are set at a level that represents an upper-bound lifetime cancer risk to an individual of between 10^{-4} to 10^{-6} and non-carcinogens are set such that the cumulative risks from exposure will not result in adverse effects to human populations. For non-carcinogens this includes consideration of sensitive sub-populations, exposures during an entire or part of a lifetime, and incorporates a margin of safety. The specified cleanup levels account for exposures from potential pathways, and through different media (e.g., soil, ground water, surface water, sediment, air, structures, biota).

Radiation is defined as a hazardous substance under CERCLA. In particular, radionuclides are designated as hazardous air pollutants by Clean Air Act (CAA) section 112, and CERCLA section 101(14)9E defines the term "hazardous substance" to include CAA hazardous air pollutants. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) states that for contaminants for which ARARs are not available or sufficiently protective, cleanup will be governed by the risk range for all carcinogens, i.e. within the cancer risk range of 10^{-4} to 10^{-6} for all exposure pathways in all contaminated media. This applies to chemical contaminants as well as radioactive contaminants. The 10^{-4} to 10^{-6} cancer risk range can be interpreted to mean that a highly exposed individual may have a one in 10,000 to one in 1,000,000 increased chance of developing cancer because of exposure to a site-related carcinogen. While cleanups will generally achieve a risk level within 10^{-4} to 10^{-6} for carcinogenic risk, risks of greater than 1×10^{-4} may be acceptable under appropriate circumstances. CERCLA guidance states that "the upper boundary of the risk range is not a

(Continued on Page 9)

PHILOSOPHIES OF RISK

HARMONY & CONFLICT IN RADIATION PROTECTION DURING CLEANUP

(Continued from Page 8)

discrete line at 1 x 10^{-4}, although EPA generally uses 1 x 10^{-4} in making risk management decisions. A specific risk estimate around 10^{-4} may be considered acceptable if justified based on site-specific conditions." Other EPA regulatory programs have developed a similar approach to determining acceptable levels of cancer risk. EPA's risk range of 10^{-4} to 10^{-6} represents EPA's opinion on what are generally acceptable levels. This has been a consistent EPA position under CERCLA and other programs for many years.

It should also be noted that cleanup levels for radioactive contamination at CERCLA sites are generally expressed in terms of risk levels, rather than millirem, as a unit of measure. CERCLA guidance recommends the use of slope factors in the EPA Health Effects Assessment Summary tables when estimating cancer risk from radioactive contaminants. Many radiation professionals are probably more familiar with estimating millirem using dose conversion factors, rather than basing cleanup on site-specific risk assessment.

This article was derived from Restoration Principles and Criteria: Superfund Program Policy for Cleanup at Radiation Contaminated Sites *by Michael Shapiro, Office of Solid Waste and Emergency Response, Environmental Protection Agency. The full text is provided in the extended articles file RENv3n1.pdf which is located in the newsletter section at http://riskcenter.doe.gov.*

SPEAK YOUR MIND

ALARA — A CONCEPT STRETCHED TOO FAR?

A 1983 *Health Physics* editorial stated that the basic tenet of keeping "radiation exposures as low as practicable" is at least as old as the radiation protection programs borne from the Manhattan project. The codification of this once philosophical goal has caused concern for added conservatism to radiation protection[1,2,3,4].

For example, radiation protection guidance for environmental remedial actions (i.e., interventions) at U.S. Department of Energy (DOE) legacy facilities is multi-layered and very conservative. This layering begins with the use of the linear-non-threshold (LNT) model. The LNT lacks a conclusive scientific basis[5, 6]. And, Gunnar Walindar, a Swedish radiobiologist, calls the LNT one of the greatest scientific scandals of our time[7]. The model extrapolates from where statistically significant radiation risk has been shown[8], i.e., 100 millisievert (mSv; 10rem) two orders of magnitude less to the current International Commission on Radiation Protection (ICRP) standard, 1 mSv (100 mrem)[9], for the protection of the public. The 1mSy public standard is one espoused by every standard setting body in the world. And, practices such as waste disposal are already considered in the public standard by the ICRP.

U.S. regulatory agencies add another layer of conservatism by reducing the ICRP standard by a factor of 4 to 7, by imposing soil cleanup dose standards of 15-25 mrem[10, 11]. Dose model scenarios regularly use the maximum exposed individual (MEI) often a farmer, who moves onto an area of concern, grows all the family food on that land, and seldom leaves home. It is after this dose is calculated that an "as low as reasonably achievable" (ALARA) assessment can be performed. This use of worst case parameters, instead of "realistic" parameters as the DOE draft ALARA standard suggests[12], adds even more layers of conservatism.

ICRP principles for those engaged in a practice, vis a vis "people at work" state that, "No practice involving exposures to radiation should be adopted unless it produces sufficient benefit to the exposed individuals or to society to offset the radiation detriment it causes"[9]. The ICRP recommendations for intervention; however, are somewhat different. a) The proposed intervention should do more good than harm. b) The form, scale, and duration of the intervention should be optimized so that the net benefit of the reduction of dose, less the risk associated with the intervention, is maximized. The Commission further states that, "In most situations, intervention cannot be applied at the source and has to be applied in the environment and to individuals freedom of action." The dose limits recommended by the commission are intended for use in the control of practices and it recommends against the application of dose limits for deciding the need for, or scope of, intervention.

This author contends that the ICRP never intended the ALARA philosophy to apply to remedial actions that fall in the intervention realm. The application of ALARA is an additional layer of unnecessary conservatism increasing risk for non-radiation caused injuries and fatalities.

The current system is not working as risks are out of balance and workers conducting environmental restoration are getting killed saving theoretical people and preventing hypothetical cancer[13]. One reason for this is that the interpretation of the promulgated guidelines developed for controlling prospective doses (i.e., the dose from practices and use of ALARA) has been mistakenly applied in situations requiring back fitting or intervention.

Bruce W. Church, Desert Research Institute

This is a condensed version of Mr. Church's article. The full text can be found in the file RENv3n1EXT.pdf in the newsletter section at http://riskcenter.doe.gov.

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SPEAK YOUR MIND

COMMENTS ON EPA'S "GUIDANCE FOR PERFORMING AGGREGATE EXPOSURE AND RISK ASSESSMENTS"

The U.S Environmental Protection Agency's (EPA) new proposed guidance for performing exposure and risk assessments in the Office of Pesticide Programs (OPP) is well-written, well-reasoned, and encourages the assessor to use good judgment. But EPA's rulemakers, managers and architects of new policy, need to better understand when, where and to what extent it should be applied.

The guidance is written from the perspective of an assessor who must analyze the aggregate exposures and risks of an already widely registered pesticide. It instructs that the assessment go only to the level of detail needed to substantiate that the pesticide can be used safely or that risks associated with a certain exposure pathway need to be mitigated.

The document closely describes practices unofficially followed for years by OPP's most senior scientists when conducting particularly difficult special reviews and re-registrations.

So why is there a problem? EPA staff are demanding unnecessary data to support an ever increasing number of resource-intensive assessments for trivial exposure pathways and non-toxic chemicals. Policy makers seem unable to decide when particular studies should be required and when an exposure scenario should be assessed at length.

Mis-implementation is already having serious consequences on the new Subpart W requirements, approval of new inert ingredients, and review of new safer pesticides. EPA must make the data requirements, policies and procedures within OPP consistent with the Guidance and restore a sense of priority.

John B. Dubeck & Andrew P. Jovanovich, Washington D.C., USA

For more information see these web sites (http://www.epa.gov/fedrgstr/EPA-PEST/1999/November/Day-10/6043.pdf or http://www.khlaw.com/Aggregate.htm) or contact John Dubeck (202/434-4125, dubeck@khlaw.com) or Andrew P. Jovanovich (202/434-4156, ajovanov@khlaw.com) of Keller & Heckman, LLP, Washington D.C. and Brussels.

GENETIC TESTING

A continuing drive exists in modern society for the reduction of risk and uncertainty. One aspect of this is the development of genetic testing for late onset hereditary diseases, such as Huntington's disease and some forms of cancer. Even if no early treatment is available, people may choose to have a genetic test to allow freedom from uncertainty for themselves or family members.

However, genetic tests cannot generally predict the timing of onset of the disease, which could be beyond the individual's lifetime, or the severity of the symptoms. Therefore genetic testing cannot give a full picture of the risks faced, and it may not always be in the interest of the individual to have a test.

Quantifying risks is generally a positive move where risk management actions can be taken to reduce the risk, but what if nothing can be done? Is it better to live with greater uncertainty or with knowledge of a high risk of a particular serious illness? Hopefully the future will bring preventative treatment for these illnesses, but in the meantime a difficult decision remains, which can only be made on an individual basis with all the available information.

Nicola Edson, United Kingdom

Information taken from the Report on Genetic Testing for Late Onset Disorders, UK Department of Health, July 1998.

SPEAK YOUR MIND is continued on page 12

SPEAK YOUR MIND

EVALUATING AND CLASSIFYING GLOBAL ENVIRONMENTAL RISKS

In its 1998 annual report about the management of global environmental risks, the German Advisory Council on Global Change developed an integral risk concept consisting of a rational risk evaluation, a *new* risk classification and corresponding risk management strategies.[1] Ortwin Renn, Council member, and Andreas Klinke, associate researcher of the Council, were the two main contributors to the risk concept.[2] This concept integrates technical, natural-scientific and social scientific concepts. From risk perception studies, eight evaluative criteria have been derived to develop a six-category risk classification system.

The eight criteria include:

- *probability of occurrence*
- *extent of damage*
- *certainty of assessment* - confidence interval of probability and the extent of damage. If the certainty of assessment is low, one needs to characterize the nature of the uncertainty in terms of statistical confidence intervals, remaining uncertainties and plain ignorance.
- *ubiquity* - geographic dispersion of potential damages
- *persistency* - temporal extension of damage
- *reversibility* - possible restoration of the situation to the pre-damage state
- *delay effect* - time of latency between initial event and actual impact of damage
- *potential of mobilization* - violation of individual, social or cultural interests and values generating social conflicts and psychological reactions by the affected people.

Based on these eight criteria, six relevant risk types can be deduced that we have illustrated with Greek mythology:

- *Sword of Damocles* - the disaster potential is very high; the probability of occurrence is very low. Examples: nuclear energy, large-scale chemical facilities and dams.
- *Cyclops* - extent of damage can be high; probability is unknown; ubiquity and persistency are rather high. Examples: floods, earthquakes volcanic eruptions, AIDS and nuclear early warning systems.
- *Pythia* - probability of occurrence and extent of damage are uncertain. Examples: release of genetically modified organisms, genetic engineering applications, and the greenhouse effect.
- *Pandora's box* - extent of damage are only presumptions; probability of occurrence is unknown; ubiquity, persistency and irreversibility are high. Examples: persistent organic pollutants and endocrine disruptors.
- *Cassandra* - extent of damage and probability of occurrence are rather high; delay effect is very high. Examples: climate change and loss of biological diversity.
- *Medusa* - extent of damage is rather low and probability of occurrence is partially uncertain; potential of mobilization is high. Example: electromagnetic fields.

Corresponding risk management strategies were selected or developed to transform unacceptable into acceptable risks, i.e. the risks should not be reduced to zero but to a level where routine management is sufficient for safety criteria. We distinguish three central categories (risk-based, precautionary, and ambiguity) of risk management strategies. The risk types *Damocles* and *Cyclops* belong to the first category, because the probability of occurrence and the extent of damage are relatively well known. The second category (*Pythia* and *Pandora)* requires predominantly precautionary strategies, because these risks exhibit a relatively high degree of uncertainty with respect to probability of occurrence and extent of damage. The risk types *Cassandra* and *Medusa* require ambiguity management. Discourse is essential if either the potential for wide-ranging damage is ignored (due to a delay effect, e.g. climate change) or harmless effects are perceived as threats (e.g. electromagnetic fields).

Andreas Klinke and Ortwin Renn, Stuttgart, Germany

[1] See WBGU, German Advisory Council on Global Change, *World in Transition. Strategies for Managing Global Environmental Risks. Annual Report 1998* (Springer, Berlin et al., 2000).

[2] The perspective presented here reflects the opinions of the two authors and are not necessarily identical with the views of the WBGU. Similar views have been published in: A. Klinke and O. Renn, *Prometheus Unbound. Challenges of Risk Evaluation, Risk Classification, and Risk Management. Working Paper No. 153 of the Center of Technology Assessment* (Stuttgart, Center of Technology Assessment, 1999); and A. Klinke and O. Renn, "Precautionary Principle and Discursive Strategies: Classifying and Managing Risks," *Journal of Risk Research* (forthcoming 2000).

About SPEAK YOUR MIND: *SPEAK YOUR MIND contains letters about articles published in* Risk Excellence Notes*. The views and opinions expressed by the authors do not necessarily state or reflect those of the United States Government, or any agency thereof, or of the Editorial Board of* Risk Excellence Notes.

UPCOMING EVENTS

U.S. ARMY CHPPM HEALTH RISK COMMUNICATION WORKSHOPS - For more information on any of the following workshops, call Laura Hoover (410/436-7715) or see the web page www.http://apbdev/hr/default.asp.

- **Introductory Health Risk Communication Workshops:**
  Mar. 20-22, 2001; White Marsh, MD
  Jul. 17-19, 2001; Seattle, WA
- **Advanced Health Risk Communication Workshops:**
  Jun. 25-28, 2001; San Antonio, TX
  Sept. 10-13, 2001; Seattle, WA
- **Communication Skills for Working with Restoration Advisory Boards Workshop:**
  Apr. 3-4, 2001; Chicago, IL

JAN. 23, 2001: South Carolina Educational Television will broadcast ***LIVING WITH RISK*** at 8PM ET. Moderated by Lynn Sherr, the program will focus on the ethical, legal, and social implications of genetic testing in the workplace. After its state-wide broadcast, the program will be distributed nationally. For more information contact Rich Jablonski, Medical University of South Carolina (843/727-6450 x6462).

FEB. 25 – MAR. 1, 2001: WASTE MANAGEMENT '01, HIGH LEVEL WASTE. LOW LEVEL WASTE, MIXED WASTES AND ENVIRONMENTAL RESTORATION – WORKING TOWARDS A CLEANER ENVIRONMENT. For more information contact WM Symposia, Inc. (520/636-0399; email for abstracts abstracts@ wmsym.org; web site http://www.wmsym.org/wm01).

MAR. 5-9, 2001: RISK ANALYSIS FOR CHEMICALS AND RADIONUCLIDES: A REVIEW OF THE STATE-OF-THE-ART, Kiawah Island, SC. For more information contact Phoebe Boelter (312/372-1255; email CAPSLTD@MCS. COM;web site http://www.racteam.com).

APRIL 2001: SYMPOSIUM ON RISK MANAGEMENT, NASA Langley, VA. For more information contact Steve Waddell (waddell_js@nns.com) or Mary Irish (DRMMDI@aol.com).

JUNE 4-8, 2001: INTERNATIONAL SCIENTIFIC SESSION MANAGEMENT OF NATURAL AND TECHNOGENIC RISKS, Sofia, Bulgaria. Languages of working sessions: English, Russian, Bulgarian. Sponsored by the University of Mining and Geology "St. Ivan Rilski". For more information, email risk_session@staff.mgu.bg or see the web site www.mgu.bg/risk_session.

ECO-INFORMA 2001

By Margaret MacDonell, Argonne National Laboratory

Communicating information among scientists, decision makers, and the community to define joint strategies for global environmental solutions is the overall theme of Eco-Informa 2001. The conference, to be held at Argonne National Laboratory in Chicago, Illinois on May 14-18, will contain four session topics:

1) Toward a sustainable environment: managing contaminated resources;
2) Public policy and due process: involving stakeholders in developing environmental solutions;
3) Environmental information in the 21st century: collection, evaluation, and dissemination for better decisions; and,
4) Engineering and bioengineering solutions: new technologies to address global problems.

In addition, short courses will be held on geographic information systems, assessing ecological risks, assessing health risks of chemical mixtures, environmental epidemiology, and multi-criteria decision analysis for ecological applications.

For more information see the web site (http://eco-informa.ead.anl.gov/).

FOR MORE EVENTS, SEE "CALENDAR"

ON OUR WEB SITE

http://riskcenter.doe.gov

INTERNATIONAL RISK NETWORK

EDITORS' NOTE: *Currently, NATO is sponsoring scientific activities related to the environmental legacies of the Cold War. At the NATO Advanced Study Institute on Risk Assessment of Cold War Facilities and Environmental Legacies, participants from 13 countries signed a memorandum to establish a Risk Assessment Network. One of the main objectives of this Network is to "identify areas of priority concern where remediation efforts are needed to reduce both domestic and transboundary hazards." The implementation of Network's objectives needs an efficient and flexible organization in each country involved.*

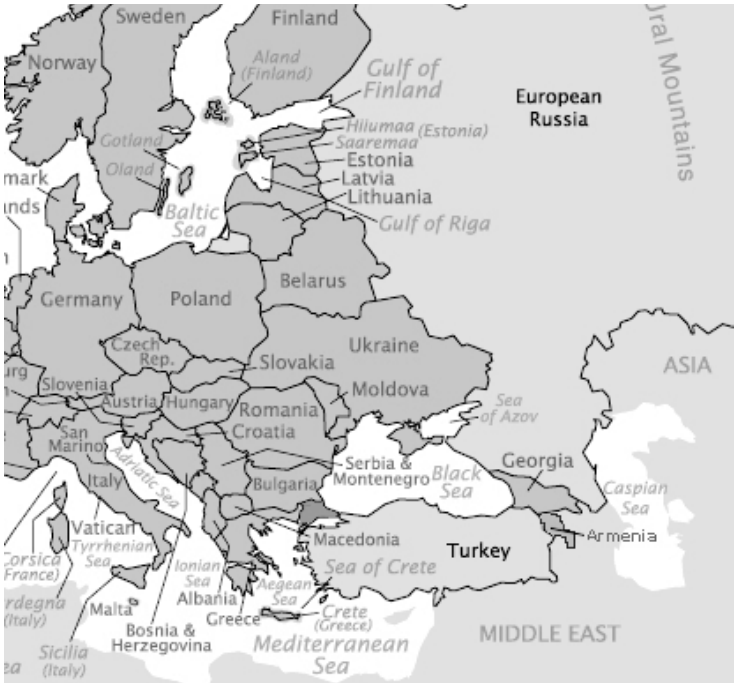
THE COLD WAR LEGACY IN ARMENIA[1]

By Olga A. Jurharyan, Ecocenter—Academy of Sciences in Armenia

In Armenia, the breakdown of the USSR left a huge group of military employees jobless. More than 80 percent of our industry consisted of military enterprises, which ceased their operations in 1992. Today, a combination of socio-economic, ecological, political, health, technologic, scientific, and education issues need to be solved and environmental risk assessment can help.

The agreement of the International Risk Network to provide mutual assistance and support by exchanging data on risk assessments is greatly appreciated. In fact, this program has the support of the governmental and scientific-research entities in Armenia. Last August, the National Group of Risk Assessment of Armenia was established. It is comprised of 16 specialists from the Armenian Ministries of Energy, Education and Agriculture, Departments of Nuclear Control and Emergency Situations, Engineering Academy, and the National Academy of Sciences. Science, information support, and personnel training are the foremost activities. Quickly, information on scientific developments and risk assessment methodologies in Armenia were compiled. From this information, the risk assessment of ecology, economy, social, technology, industrial hygiene, and defense profiles, as well as, natural catastrophies (earthquakes), nuclear energy, and agriculture are of the most interest.

EAST EUROPEAN REGION



Courtesy: WorldAtlas; http://www.worldatlas.com

Environmental education is very important. It is essential to introduce and adopt such programs as environmental impact assessment, environmental control, and management of environmental risk assessment. Thanks to the U.S. Department of Energy's Center for Risk Excellence and the Medical University of South Carolina, we have received literature, methodologies, audio and video cassettes, and practical recommendations on environmental risk assessment. This material served as a basis for establishment of the Foundation of Environmental Risk Assessment in Armenia (The Foundation). Its goal is to train students, young scientists, and others interested in risk assessment. The Foundation is based at the Center for Ecological-Noosphere Studies at the National Academy of Sciences.

It has been suggested that a program, named "Caucasus," that would involve the countries of the Black Sea basin, the Mediterranean region, and the Caspian Sea be formed. Caucasus would 1) implement state-of-the-art environmental risk assessment, 2) studies of social and economic status, and 3) create necessary risk databases and environmental risk maps for those regions. Armenia is a suitable starting point for Caucasus because of its central geographic location, its combination of natural, environmental, and social-economic problems, and its extensive scientific potential – more than 100 research institutions for 3 million people. And by being the first Soviet republic to declare democratic principles it has endured many changes and possesses an historic perspective that other countries will not have.

At the dawn of the third millennium, we glance to the future. To make it beautiful, we must do a great job. Happy New 2001 Year! Wishing you health, happiness, clean air, clear waters, peaceful blue sky, many flowers, smiles, and success in your careers.

For more information email Dr. Jurharyan at the Ecocenter, Academy of Sciences of Armenia (ecocenter@pnas.sci.am). Center for Ecological-Noosphere Studies

1 Armenia is one of 13 countries that participated in the development and adoption of the International Risk Network Memorandum of Understanding for exchange of risk assessment data pertaining to the Cold War.

INTERNATIONAL RISK NETWORK

THE ROMANIAN BRANCH OF RISK ASSESSMENT NETWORK

By Dr. Florin Glodeanu, The Romanian Foundation for Energy and Environment

In Romania, we have many foundations and non-government organizations (NGO) dealing with environmental issues, including impact, site restoration, waste management, etc. To host the activities of the Risk Assessment Network, we selected the Romanian Foundation for Energy and Environment (FREM), headquartered in Bucharest. Its objectives are compatible with the Network's: environmental management, training, consultance, and public information. The Romanian Branch of the Network includes scientists and analysts involved in risk assessment from nuclear research and development organizations, environmental protection research, universities, and NGO activities.

The use of risk assessment in our country is not new. In the main industrial activities, health risk evaluation is a current practice. The probabilistic risk assessment was introduced in the nuclear field, in the 1980s, with International Atomic Energy Agency's technical assistance. According to the new (mid-1990s) Romanian Environmental Act, the environmental impact assessment is required for environmental licensing. Only in the last five years, has the quantitative risk assessment and modeling been used within the framework of an European Union Risk Project (EU–PHARE).

According to the EU's regular reports on progress toward improvement, Romania still faces very serious problems for air protection, water management and waste management. No progress has been made with industrial pollution control and in the risks where Romania should make a particular effort to identify the needs and assess implications for improvement. There is an urgent need to establish an overall environmental strategy that includes cost assessments, implementation, and financing plans. In this context, risk assessment becomes an indispensable tool for the decision-making activities.

For the Risk Assessment Network, we suggest following the example of two successful European projects. The CARACAS Project (Concerted Action on Risk Assessment for Contaminated Sites) has many similarities with the goals of the Network, including:

- Establishment of an information network on risk assessment issues;
- Stimulation of multinational co-operation on scientific aspects;
- Workshops on scientific aspects of contaminated land risk management; and,
- Development of a generic methodology for risk assessment of contaminated sites.

The second European project is named RESTRAT. The main objective of this project was to develop a generic methodology for ranking of restoration techniques as a function of site and contaminant characteristics. The development of the generic methodology is based on an analysis of existing remediation methodologies and contaminated sites, and was structured as follows:

- Identification of relevant cases, representative for important classes of contaminated sites and characterization of the sites;
- Characterization of relevant restoration techniques;
- Development of risk assessment methodologies;
- Development of a selection methodology of restoration options; and,
- Formulation of generic conclusions and development of a manual.

The pilot project to be implemented in Romania within the framework of the Risk Assessment Network refers to risk assessment methodology for a radioactive waste disposal site (vadoze zone). The following steps have been implemented:

1. Site characterization data (geology, hydrology, geochemistry, tectonics and seismicity, surface processes, meteorology and climate, impact of human activities); and,
2. Determination of waste inventory and waste characteristics.

The assessment of risk to human health and the environment is expected to be implemented with the support of the Network.

SUBMITTAL OF ARTICLES, LETTERS, COMMENTS, & QUESTIONS

Upcoming issues of *Risk Excellence Notes* will focus on:

- Worker Exposure to Beryllium
- Disposition of Nuclear Materials
- National Security & Protection from Bioterrorism
- Cultural Risk & Quality of Life
- Pervasive Chemicals
- Long-Term Resource Management

Submittal of articles, address changes, and information for *Risk Excellence Notes* is encouraged and should be sent to Mary Jo Acke Ramicone or Nancy Lane at:

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